Space Weather Technical Forecast

Issued on Saturday, 14 May 2022 at 01:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: R1-R2 radio blackouts likely. Chance (30%) of G1 / Minor geomagnetic storm on day 3 (16th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, although multiple low to high C-class flares were observed throughout the period. These were mainly originating from AR3006 and AR3007 but also from the new region, AR3011, in the northeast limb. Multiple CMEs were observed in satellite imagery and whilst we are awaiting results from analysis, they are not considered to be Earth directed. There are currently six sunspot regions on the visible disc. The largest and most complex region remains AR3007, nearing the central meridian in the southern hemisphere. This region still displays a weak delta spot in its central part. Both AR3006 (Dao/Beta) and AR3008 (Cao/Beta) have started to decay, with several spots slowly disappearing. AR3010 (Dao/Beta) is now in full sight but is not showing much activity. A new sunspot region, AR3011, has emerged in the northeast limb. It is currently classed as a Cso/Beta but could become more complex as further spots continue to emerge. All other regions are weak and stable.

Solar Wind / Geomagnetic Activity: The solar wind speed as measured by ACE & DSCOVR at L1 has been ambient, generally around 330-360 km/s, with a generally average density. The total interplanetary magnetic field strength (IMF), Bt, was weak, its north-south component, Bz, remaining mostly negative and fluctuating between 0 and -6nT. The Phi angle was largely positive (away from the sun) but became briefly negative (towards the Sun) between 13/0900-1200 UTC. Resultant geomagnetic activity was largely Quiet, with one Unsettled period observed at 13/2100-2400 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background levels through the last 24 hours. The high energy electron flux (greater than 2 MeV) has remained at background levels while the corresponding electron fluence remained well below the Active (1e8 integrated pfu) threshold, with a slight rising trend. 1.03e6 integrated pfu observed at 14/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low, though likely to become Moderate, mainly from the new region AR3011, and accompanied by R1 or R2 radio blackouts at times.

Solar Wind / Geomagnetic Activity: Solar winds are expected to remain slow-ambient initially, along with a largely Quiet geomagnetic activity. However a coronal hole high speed stream is expected to connect with the Earth on day 3 (16th), with winds becoming elevated on days 3 and 4. This may enhance geomagnetic activity with Unsettled to Active periods on days 3 & 4 (16th and 17th), with a chance of a G1 / Minor Storm at the onset of the high speed stream (day 3 - 16th).

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Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to be at background levels during this period, although there is slight risk of an S1-S2 event due to the potentially arrival of a large sunspots region. The high energy electron flux (greater than 2 MeV) is forecast to remain at normal background levels through much of the forecast period, with the 24-hour electron fluence staying below Active (1e8 integrated pfu) threshold.

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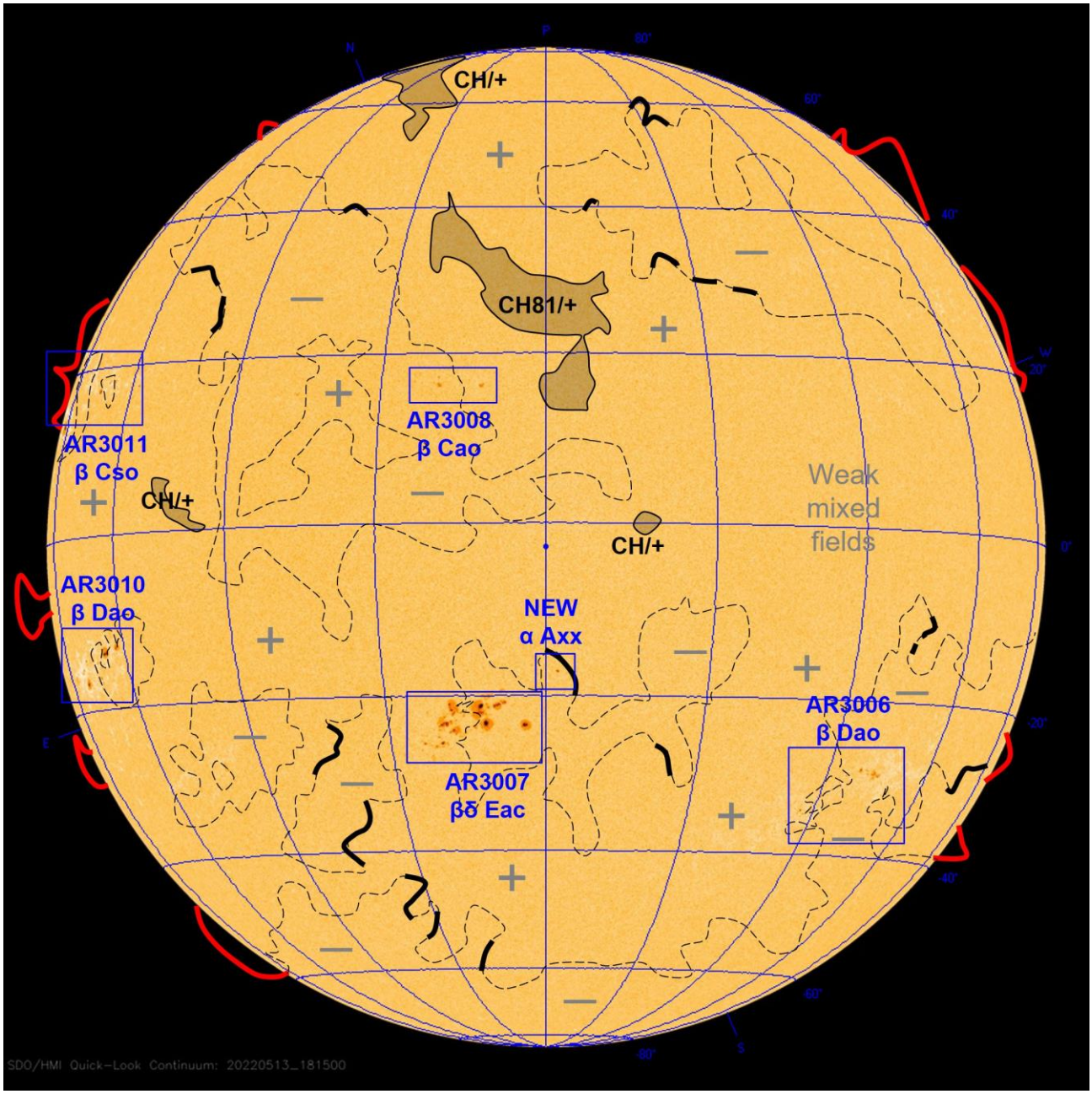
Figure 1. Solar Analysis Valid 13/05/2022 1800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

An X1.5 flare on 10 May from south-centre disc appears to have produced an asymmetric CME, combining with a long-period flare from the eastern limb. Coronagraph analysis remains inconclusive and although there is a chance of seeing a transient feature at L1 later on the 13th May, this remains unlikely, with no significant portion of this CME complex heading for Earth.

Solar winds are expected to be slow-ambient through days 1-2 (13th-14th) otherwise. They should become elevated on days 3-4 (16th-17th), under the influence of the high speed stream originating from CH81/+. This feature generated solar winds up to 570 km/s on the previous. Given it is larger this time around, it is not impossible to see solar winds in excess of 600km/s. While geomagnetic activity is expected to be largely Quiet on days 1-2, these elevated solar winds may trigger some Unsettled and Active periods on days 3-4 (16th), with a chance of a G1 / Minor Storm on day 3 (16th), due to the arrival of the CIR associated to CH81/+.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	30	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

NIL.

Radio Blackouts - X-Ray Flares:

Solar activity has been Low over the past 24 hours, although multiple low to high C-class flares were observed throughout the period. These were mainly originating from AR3006 and AR3007

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but also from the new region, AR3011, in the northeast limb. This region is relatively simple at the moment but could become more complex as further spots continue to emerge on to the visible disc. This is particularly true as a bright flux region is apparent on STEREO-A EUVI 195 imagery, potentially indicating the presence of a large sunspot region. This region will be rotating onto the visible disc over the coming days and is likely to enhance the flare risk. One particularly bright region, just round the northeast limb, was responsible for the M1.4 flare at 12/2020 UTC.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 M Class**	No	30	40	50	50
Very Active	**R3 to R5 X Class**	No	5	5	10	10

Figure 2: X-Ray Flares, as observed at GOES, showing a background of C-class flares

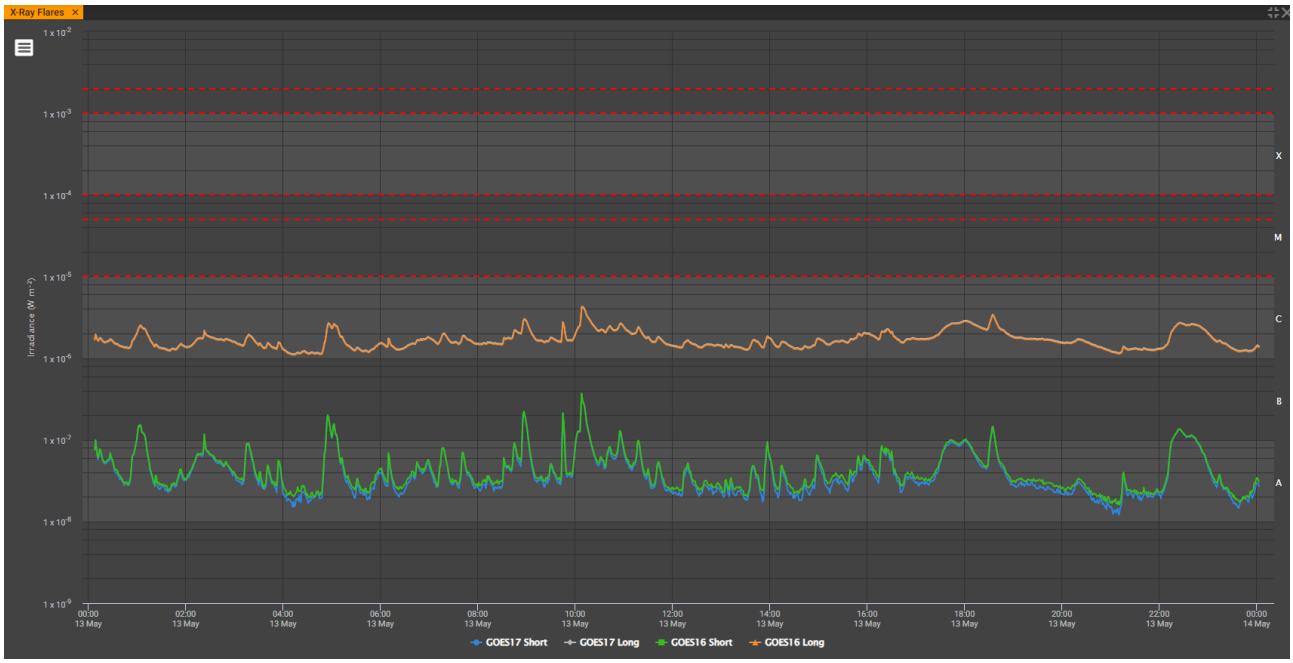

Figure 3: SDO/AIA 304 satellite image showing recent prominence ejecta in the southwest limb (not Earth-directed).

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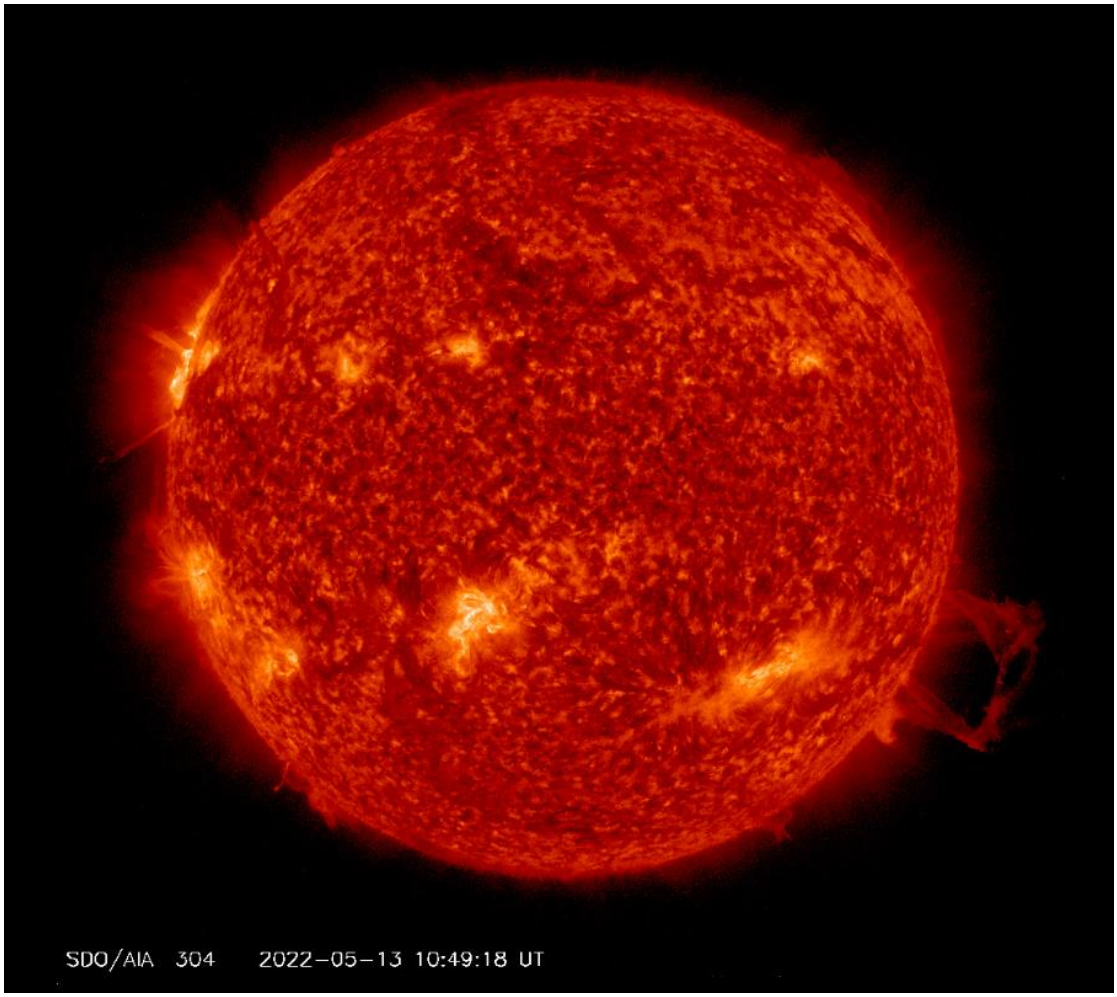

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is close to background levels and is generally expected to remain at that level throughout the period. However, there is a slight chance of an S1-S2 event during the forecast period, primarily due to the bright flux region apparent on STEREO-A EUVI 195 imagery. This region appears very large and bright, potentially indicating the presence of an active sunspots region. This region is expected to emerge in the northeast limb over the coming days, with AR3011 only representing the precursor.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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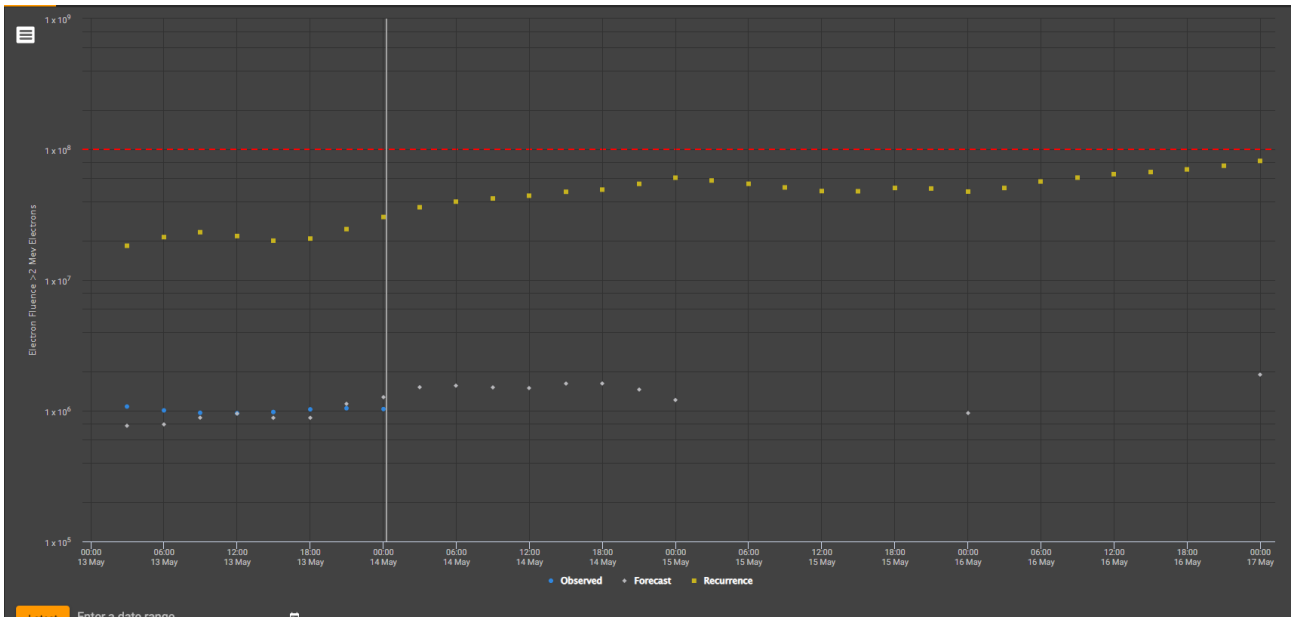
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2 MeV) is expected to be at background levels through days 1-3 but may rise on day 4 (17th) once the high speed stream originating from CH81/+ becomes established. The corresponding electron fluence is therefore expected to remain below the Active (1e8 integrated pfu) threshold during the forecast period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: REFM showing a flat trend well below the Active threshold.



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